

# Microgram

## Bulletin

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VOL. XXXVII, NO. 12  
December 2004

### - INTELLIGENCE ALERT -

#### PHENYLPROPYLMETHYLAMINE IN BROWARD COUNTY, FLORIDA

The DEA Southeast Laboratory (Miami, Florida) recently received a small amount of yellow powder, submitted as an unknown, suspected designer drug (see Photo 1). The exhibit was submitted by the Broward County Sheriff's Office Crime Laboratory, and was taken from a 633 gram seizure previously submitted to that laboratory (details of seizure not provided). The powder did not give a color change with either the Scott's test or Mecke reagent; however, a slow orange color developed with the Marquis reagent, and a deep blue color was observed with sodium nitroprusside. Analysis by GC/MS on both a chloroform extract (from a basified solution) and the TPC derivative, and by FTIR and NMR, indicated racemic phenylpropylmethylamine (PPMA) hydrochloride (quantitation not performed). This is believed to be the first ever submission of PPMA HCl to the Southeast Laboratory.



Photo 1

[Editor's Notes: PPMA is the "mistake" product from the use of an incorrect precursor in illicit "prop-dope" methamphetamine laboratories (that is, 2-phenylpropanal instead of phenyl-2-propanone), and has been occasionally reported to *Microgram* since 1982. It has minimal (if any) CNS stimulant activity, and is not controlled. A comprehensive analytical profile of PPMA was published in *Microgram* 1998;31(10):269. Note that all issues of *Microgram* prior to January 2003 are law enforcement restricted.]

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**- INTELLIGENCE ALERT -**

**QUILTED UNISEX GARMENTS CONTAINING HEROIN IN NEW YORK, NEW YORK**

The DEA Northeast Laboratory (New York, New York) recently received a submission of 19 unisex garments containing quilted liners underneath the upper body area, containing an offwhite powder within the quilted pockets, suspected heroin (see Photos 2 and 3). The garments were seized in the New York City area by agents from the DEA New York Division (details of seizure not available). Analysis of the powder (total net mass 3701.7 grams) by GC/FID, GC/MS, and FTIR confirmed an average of 75 percent heroin hydrochloride. Three of the quilted liners contained only heroin, while the other sixteen contained a mixture of heroin, acetaminophen, caffeine, and lidocaine. The origin of the garments was not determined; however, similar clothing items have originated primarily in Central and South America (but also from the Middle East). The Northeast Laboratory has previously received a variety of similarly quilted clothing containing controlled substances within the quilted pockets.



**Photo 2**



**Photo 3**

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**- INTELLIGENCE ALERT -**

**OPIUM IN ROLLS OF WALLPAPER IN TARZANA, CALIFORNIA**

The DEA Southwest Laboratory (Vista, California) recently received two rolls of wallpaper, each with a compartment inside (created by "thinning" the core tube) that was used to conceal a dark brown substance (total net mass 1152 grams), suspected opium. The exhibits were seized by Immigration and Customs Enforcement personnel at an express mail facility in Memphis, Tennessee and were submitted to the laboratory after an attempted controlled delivery in Tarzana, California. Each roll was approximately two feet long and three inches in diameter. A thin outer layer of wallpaper was wrapped around the substance, which was packaged in clear plastic and molded around the thinned plastic core (see Photos 4 - 5). Analysis by ATR-IR and GC, and GC/MS indicated codeine, morphine, thebaine, and papaverine, confirming opium (quantitations not performed). The origin of the rolls was reported only as "overseas". This was the first such submission of this type smuggling technique to the Southwest Laboratory.



**Photo 4**



**Photo 5**

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**- INTELLIGENCE ALERT -**

**CREATINE IN ECSTASY TABLETS IN OKLAHOMA CITY, OKLAHOMA**

The DEA South Central Laboratory (Dallas, Texas) recently received 50 bluish-purple tablets with a "\$" logo on one side and half-score on the other side, weighing 262 milligrams each, suspected MDMA (see Photo 6; note that the color in the photo is not true). The tablets were acquired in Oklahoma City as a result of an undercover purchase by agents from the DEA Oklahoma City Division. Analysis by GC, GC/MS, FTIR, and HPLC confirmed 55 milligrams of 3,4-methylenedioxymethamphetamine hydrochloride per tablet, along with 49 milligrams of creatine per tablet (creatine is a health food supplement). This is believed to be the first submission of MDMA tablets containing creatine to the South Central Laboratory.

[Editor's Notes: The analytical profile for creatine has been presented in two recent articles in *Microgram*: 2000;33(8):223 and 2001;34(2):33. Note that all issues of *Microgram* prior to January 2003 are law enforcement restricted.]



**Photo 6**

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**- INTELLIGENCE ALERT -**

**2C-B LABORATORY SEIZED IN TIOGA COUNTY, NEW YORK**

[From the NDIC *Narcotics Digest Weekly* 2004;3(46):3  
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On October 17, 2004, New York State Police (NYSP) seized a clandestine 2C-B laboratory after responding to a disturbance at a private residence in the rural community of Lockwood. According to NYSP officers, a male in his early twenties allegedly obtained precursor chemicals via the Internet and manufactured 2C-B in the laboratory he operated from the basement of his residence. NYSP suspects that he also was distributing 2C-B. The Tioga County Hazardous Materials Team, NYSP Community Narcotics Enforcement Team of the Southern Tier, and Lockwood Fire Department remediated the laboratory.

NDIC Comment: 2C-B (4-bromo-2,5-dimethoxyphenethylamine, also known as Nexus) is a synthetic hallucinogen that is produced in clandestine laboratories. Producers of synthetic hallucinogens such as 2C-B usually act independently and often purchase precursor chemicals using the Internet. 2C-B laboratories have been seized in Arizona, California, South Dakota, Canada, and Europe. 2C-B has been a Schedule I controlled substance under the Controlled Substances Act since 1994; however, DEA reports first encountering 2C-B in 1979. 2C-B powder, capsules, and tablets have been seized at locations throughout the United States, particularly at venues in which club drugs such as MDMA (3,4-methylenedioxymethamphetamine, also known as ecstasy) are available and abused.

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**- INTELLIGENCE BRIEF -**

**DEA AVIATION DIVISION AND DEA YAKIMA RESIDENT OFFICE SEIZE SOPHISTICATED MARIJUANA GROWS  
IN KLINKITAT COUNTY, WASHINGTON**

In late August, the Aviation Division's Cannabis Eradication Response Team (CERT), in conjunction with the Yakima Resident Office and state and local law enforcement, seized approximately 65,000 marijuana plants with an estimated street value of nearly \$35 million. The marijuana grows were located on the Yakima Nation Indian Reservation in Klickitat County, Washington (see Photo 7). Each grow had an irrigation system sophisticated enough to provide water for individual plants. Additionally, each plot had a camp which housed someone who tended the plants. No one was present at either grow site at the time of the seizures; however, two arrests were made shortly thereafter.



**Photo 7**

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**- INTELLIGENCE BRIEF -**

**LARGEST CANNABIS GROW SITE IN SOUTHERN UTAH HISTORY SEIZED**

[From the NDIC *Narcotics Digest Weekly* 2004;3(45):4  
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Some Details Withheld in Accordance with *Microgram* Policy.]

On October 8, 2004, Washington County Drug Task Force agents in southern Utah seized the largest cannabis grow site in that area's history and arrested three Mexican national males at the site and a fourth the next day near St. George. The site was located along a stream in a secluded area near the Pine Valley district of the Dixie National Forest, and included over 1,500 cannabis plants. Task force agents subsequently seized 814 cannabis plants growing among scrub oak trees, 764 plants in the drying stage, and 50 pounds of processed marijuana. Cultivators used a gravity-flow irrigation system that allowed water from a nearby stream to flow through plastic tubing to the grow site. Law enforcement authorities believe that several other accomplices may have left the area for southern California or Mexico. Agencies participating in the investigation include Bureau of Land Management rangers, DEA, Ivins Department of Public Safety, St. George Police Department, USDA Forest Service, Utah Department of Public Safety, Washington County Search and Rescue, and the Washington County Sheriff's Office.

NDIC Comment: Mexican DTOs frequently choose remote areas of National Forest Service land to cultivate cannabis and often employ undocumented aliens from Mexico to live onsite and tend these plots. Three of the men arrested during this investigation were Mexican nationals who stated that they had come to the area from California specifically to tend and harvest the cannabis plants. The marijuana was processed at the cultivation site and distributed in California.

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**- INTELLIGENCE BRIEF -**

**ANABOLIC STEROID CONTROL ACT OF 2004**



[Information from the DEA Office of Diversion  
Drug and Chemical Evaluation Section; Unclassified]

On October 22, 2004 the President signed into law the Anabolic Steroid Control Act of 2004, Public Law 108-358. This law amends the Controlled Substances Act to change the definition of "anabolic steroid" and to add 36 steroids to the list of specifically controlled steroids. The new provision became effective January 20, 2005 and brought to 59 the total number of steroids controlled.

This law amends 21 U.S.C. \* 802 (41), which defines the term "anabolic steroid". This amendment removes the phrase "that promotes muscle growth" from the definition. This means that in a prosecution for trafficking in a substance which the Government maintains is an anabolic steroid, the Government does not have to prove that the substance promotes muscle growth.

The law also adds 36 specific substances to the list of substances which are anabolic steroids. This list includes the substance 4-androstenedione, also known as "Andro".

This law also controls the esters of the listed steroids and the salts of those esters. However, it removed from automatic control the isomers of listed steroids.

In addition, the new law directs the United States Sentencing Commission to review the Federal Sentencing Guidelines with respect to offenses involving anabolic steroids and consider amending the guidelines to provide increased penalties.

Section 812, Schedule III (E) of the Controlled Substances Act specifically provides that those substances defined as anabolic steroids are Schedule III Controlled Substances. These new provisions became effective on January 20, 2005.

Questions concerning the law may be directed to Attorney Charlotte Mapes at 703/632-5342. Specific questions concerning anabolic steroids may be directed to the Drug and Chemical Evaluation Section at 202/307-7183.

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## SELECTED REFERENCES

[Notes: Selected references are a compilation of recent publications of presumed interest to forensic chemists. Unless otherwise stated, all listed citations are published in English. If available, the email address for the primary author is provided as the contact information. Listed mailing address information (which is sometimes cryptic or incomplete) exactly duplicates that provided by the abstracting services. In addition, in order to prevent automated theft of email addresses off the Internet postings of *Microgram Bulletin*, unless otherwise requested by the corresponding author, all email addresses reported in the Bulletin have had the "@" character replaced by "-at-"; this will need to be converted back (by hand) before the address can be used.]

1. Al-Amri AM, Smith RM, El-Haj BM, Juma'a MH. **The GC-MS detection and characterization of reticuline as a marker of opium use [Erratum]**. Forensic Science International 2004;142(1):59. [Editor's Notes: Provides a correction to the original article, published 2004;140(2-3):175. Contact: Sharjah Police Forensic Science Laboratory, Sharjah, United Arab Emirates.]
2. El-Haj BM, Al-Amri AM, Ali HS. **Heroin profiling: Mannitol hexaacetate as an unusual ingredient of some illicit drug seizures**. Forensic Science International 2004;145(1):41. [Editor's Notes: The identification and presence of the title impurity is discussed. Contact: Sharjah Police Forensic Science Laboratory, Sharjah, United Arab Emirates.]
3. Escamilla B, Bertsch A. **N,N-Dimethylamphetamine in Sacramento**. Journal of the Clandestine Laboratory Investigating Chemists Association 2004;14(4):19. [Editor's Notes: Presents the analysis of samples of dimethylamphetamine and also mixed samples of methamphetamine and dimethylamphetamine. Note that JCLICA is a law enforcement restricted journal. Contact: Sacramento County, Office of the District Attorney, Laboratory of Forensic Services, 4800 Broadway, Suite 200, Sacramento, CA 95820.]
4. Frederick KA, Pertaub R, Ski Kam NW. **Identification of individual drug crystals on paper currency using Raman microspectroscopy**. Spectroscopy Letters 2004;37(3):301. [Editor's Notes: Presents and discusses the title study, using simulated drugs (isoxyuprine and norephedrine) and two common excipients (benzocaine and lidocaine). Fluorescence issues with U.S. currency are discussed. Contact: Department of Chemistry, College of the Holy Cross, Worcester, MA 01610.]
5. Hennessy SA, Moane SM, McDermott SD. **The reactivity of gamma-hydroxybutyric acid (GHB) and gamma-butyrolactone**

**(GBL) in alcoholic solutions.** Journal of Forensic Sciences 2004;49(6):1220. [Editor's Notes: Presents a study of the formation of esters of GHB, with an emphasis on the formation of the ethyl ester in alcoholic beverages. Contact: Forensic Science Laboratory, Garda H.Q., Phoenix Park, Dublin 8, Ireland.]

6. Inoue H, Iwata Y-T, Kanamori T, Miyaguchi H, Tsujikawa K, Kuwayama K, Tsutsumi H, Katagi M, Tsuchihashi H, Kiski T. **Analysis of benzylpiperazine-like compounds.** Japanese Journal of Forensic Identification 2004;9(2):165. [Editor's Notes: Provides comprehensive analytical data for BZP and TFMPP. Contact: National Research Institute of Police Science, 6-3-1 Kashiwanoha, Kashiwa, Chiba 277-0882, Japan.]

7. Keely B. **Forensic chemistry. Drugs on money.** Chemistry Review 2004;13(4):22. [Editor's Notes: A brief review. Contact: Department of Chemistry, University of York, UK.]

8. Kirby DA. **Preparation and analysis of cocaine hydrochloride in a silicone matrix.** Journal of the Clandestine Laboratory Investigating Chemists Association 2004;14(4):14. [Editor's Notes: Presents the analysis of cocaine that is mixed in silicone and formed into consumer products for smuggling. Includes pertinent commentary from a cooperating individual. Note that JCLICA is a law enforcement restricted journal. Contact: DEA Southwest Laboratory, 2815 Scott Street, Vista, CA 92081.]

9. Lavins ES, Lavins BD, Jenkins AJ. **Cannabis (marijuana) contamination of United States and foreign paper currency.** Journal of Analytical Toxicology 2004;28(6):439. [Editor's Notes: Presents the title study. Contact: The Office of the Cuyahoga County Coroner, 11001 Cedar Road, Cleveland, OH 44106.]

10. Magnuson EE, Burnett LJ. **Screening system for detection of contraband swallowed narcotics.** Applied Magnetic Resonance 2004;25(3-4):567. [Editor's Notes: Presents a nonimaging, low-frequency NMR technique to detect pellets of heroin or cocaine. Contact: Quantum Magnetix, Inc., San Diego, CA (zip code not provided in the abstract).]

11. Sato M, Hida M, Nagase H. **Analysis of the pyrolysis products of methamphetamine.** Journal of Analytical Toxicology 2004;28(8):638. [Editor's Notes: Presents the title study. Includes pyrolysis of deuterium labeled methamphetamine. Contact: Scientific Investigation Research Laboratory, Aichi Pref. Police H.Q., 2-1-1 Sannomaru, Naka-ku, Nagoya 460-8502 Japan.]

12. Waumans D, Hermans B, Bruneel N, Tytgat J. **A neolignan-type impurity arising from peracid oxidation reaction of anethole in the surreptitious synthesis of 4-methoxyamphetamine (PMA).** Forensic Science International 2004;143(2-3):133. [Editor's Notes: A forensic marker for peracid oxidation of anethole (a precursor for illicit synthesis of PMA) is identified and discussed. Contact: Laboratory of Toxicology, Eduard van Evenstraat 4, 3000 Leuven, Belgium.]

#### **Additional References of Possible Interest:**

1. Almirall JR, Trejos T, Hobbs A, Perr J, Furton KG. **Mass spectrometry in forensic science.** Advances in Mass Spectrometry 2004;16:167. [Editor's Notes: A review of the title topic; includes some applications of mass spectrometry to the analysis of drugs of abuse (unspecified in abstract). Contact: International Forensic Research Institute, Florida International University, Miami, FL 33199.]

2. van Amsterdam JGC, Best W, Opperhuizen A, de Wolff FA. **Evaluation of a procedure to assess the adverse effects of illicit drugs.** Regulatory Toxicology and Pharmacology 2004;39(1):1. [Editor's Notes: Presents a theoretical approach to the title issue, focusing on new synthetic illicit drugs. Contact: Pathology and Genetics, Laboratory for Toxicology, National Institute for Public Health and the Environment (RIVM), Bilthoven, Neth.]

3. Chen Y, Pawliszyn J. **Solid-phase microextraction field sampler.** Analytical Chemistry 2004;76(22):6823. [Editor's Notes: Presents the title study. Contact: Department of Chemistry, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.]

4. Drummer O, Odell M. **Forensic pharmacology of abused drugs.** Arnold: London, UK, 2001. [Editor's Notes: No abstract provided. Contact: No contact information was provided.]

5. George S. **Has the cocaine epidemic arrived in the UK?** Forensic Science International 2004;143(2-3):187. [Editor's Notes: Presents a survey of cocaine use in the UK from 1996- 2002. Contact: Regional Laboratory for Toxicology, City Hospital NHS Teaching Trust, Dudley Road, Birmingham B18 7QH, UK.]

6. Jasper JP, Fourel F, Eaton A, Morrison J, Phillips, A. **Stable isotopic characterization of analgesic drugs.** Pharmaceutical Technology 2004;28(8):60. [Editor's Notes: Drugs not specified in the abstract - appears to be for characterization of commercial

pharmaceuticals. Contact: Molecular Isotope Technologies, LLC, Niantic, CT 06357.]

7. Kidwell DA, Riggs LA. **Comparing two analytical methods: Minimal standards in forensic toxicology derived from information theory.** Forensic Science International 2004;145(2- 3):85. [Editor's Notes: Presents an information theory based method for comparing new with existing analytical instrumentation. Contact: Chemistry Division, Naval Research Laboratory, Washington, DC 20375.]

8. Lambert W. **Pitfalls in LC-MS(-MS) analysis.** Bulletin TIAFT 2004;34(2):59. [Editor's Notes: Discusses the title subject. Includes numerous references. Contact: Laboratorium voor Toxicologie, Universiteit Gent, Harelbekestraat 72, B-9000 Gent, Belgium.]

9. Meyers JE, Almirall JR. **A study of the effectiveness of commercially available drink test coasters for the detection of "date rape" drugs in beverages.** Journal of Analytical Toxicology 2004;28(8):685. [Editor's Notes: Presents the title study. Contact: Department of Chemistry and Biochemistry and International Forensic Science Research Institute, Florida International University, University Park, Miami, FL 33199.]

10. Mukhopadhyay R. **Portable FTIR spectrometers get moving.** Analytical Chemistry 2004;76(19):369A. [Editor's Notes: A mini-review of the title instruments; includes a comparative survey of available instruments. Contact: No contact information was provided.]

11. Nguyen DH, Berry S, Christensen DL, Klymowsky C. **Laser desorption and detection of explosives, narcotics, and other chemical substances.** U.S. Pat. Appl. Publ. US 20040169845 A1 2 Sep 2004. CLASS: ICM: G01N021-01 NCL: 356036000. APPLICATION: US 2002- 62135 1 Feb 2002. [Editor's Notes: Presents the title patent. Narcotics not specified in abstract. Contact: Can. (No further addressing information was provided).]

12. Vorce SP, Sklerov JH. **A general screening and confirmation approach to the analysis of designer tryptamines and phenethylamines in blood and urine using GC-EI-MS and HPLCelectrospray- MS.** Journal of Analytical Toxicology 2004;28(6):407. [Editor's Notes: Presents the analysis of the pentafluoropropionic derivatives of the title drugs; focus is on biological matrices. Contact: Office of the Armed Forces Medical Examiner, Division of Forensic Toxicology, Armed Forces Institute of Pathology, Rockville, MD 20850.]

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## THE DEA FY - 2005 STATE AND LOCAL FORENSIC CHEMISTS SEMINAR SCHEDULE

The remaining FY - 2005 schedule for the DEA's State and Local Forensic Chemists Seminar is as follows:

February 7 - 11, 2005  
May 9 - 13, 2005  
July 11 - 15, 2005  
September 19 - 23, 2005

Note that the school is open only to forensic chemists working for law enforcement agencies, and is intended for chemists who have completed their agency's internal training program and have also been working on the bench for at least one year. There is no tuition charge for this course. The course is held at the AmeriSuites Hotel in Sterling, Virginia (near the Washington/Dulles International Airport). A copy of the application form is reproduced on the last page of the August 2004 issue of Microgram Bulletin. Completed applications should be mailed to the Special Testing and Research Laboratory (Attention: Pam Smith or Jennifer Kerlavage) at: 22624 Dulles Summit Court, Dulles, VA 20166. For additional information, call 703/668-3337.

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## SCIENTIFIC MEETINGS

1. **Title:** AAFS 57th Annual Meeting (Fifth and Final Posting)  
**Sponsoring Organization:** American Academy of Forensic Sciences  
**Inclusive Dates:** February 21 - 26, 2005  
**Location:** New Orleans, LA  
**Contact Information:** See Website

# Computer Corner

## Evidentiary Perspectives

#189

by Michael J. Phelan

DEA Digital Evidence Laboratory

The goal of all law enforcement forensic programs is to gather accurate and complete findings, and ultimately to have those findings presented in court. Legal rules of admissibility impact all investigative and forensic practices that involve evidence collection, labeling, handling, examination, and reporting. Digital Evidence is no exception. However, there are two distinct evidentiary digital evidence concepts – “Business Records” and “Best Evidence” – with which digital evidence examiners must be familiar. Digital evidence expert witnesses may be required by a court to explain the nature, handling, and examination of the evidence from either point of view.

### Business Records

The first perspective involves the court’s acceptance of digital evidence as “business records” that fall within the business records exemption in the Federal Rules of Evidence 803(6). This rule defines a business record as: “a memorandum, report, record, or data compilation, in any form, of acts, events, conditions, opinions, or diagnoses, made at or near the time by, or from information transmitted by, a person with knowledge, if kept in the course of a regularly conducted business activity, and if it was the regular practice of that business activity to make them memorandum, report, record, or data compilation, all as shown by the testimony of the custodian, or other qualified witness, or by certification that complies with Rule 902(11), Rule 902(12), or a statute permitting certification, unless the source of the information or method or circumstances of preparation indicate lack of trustworthiness”.

An examiner must address some key legal concerns when introducing digital evidence as “business records”. The principal concern is the trustworthiness of the records. Technical issues that may require clarification include the security (read/write access rights) surrounding the file structures or databases that store data, the software program that manipulates the raw data, and the algorithms that aggregate and present summary data.

Examples of computer-generated “business records” include stored e-mail folders, financial transactional data, computer communication and operating system logs, inventory data, and sales records. Business records are most often recovered in financial fraud and money laundering investigations. Drug diversion cases, pharmacy, chemical company, and even doctor-patient records can fall within the meaning of business records. These types of records may be voluminous and can contribute to documenting “intent” by the frequency and preponderance of certain records or transactions.

### Original Evidence

Federal Rule of Evidence 1001(1) has a broad definition of original evidence, which defines “writings and recordings” to include magnetic, mechanical, or electronic methods of “setting down letters, words, numbers, or their equivalent.” Clearly, computer data that is either stored or transmitted meets this definition. Most digital evidence investigations involve seized or surrendered original evidence objects such as computers and their hard drives, storage media (diskettes, CDs, or DVDs), cell phones, or Personal Digital Assistants (PDAs). However, it is not considered to be a best practice to directly examine the original object(s) because of the potential of changing or erasing data contained on said object(s). On occasion, exigent circumstances or technical limitations may require processing the original evidence, but a large majority of the evidentiary digital evidence objects can be duplicated, and the duplicate examined for potential probative information. The use of a duplicate thereby eliminates the risk that data on the original evidence will be destroyed or changed.

### Duplicate Evidence

Federal Rule of Evidence 1003 provides that a “duplicate is admissible to the same extent as an original unless (1) a genuine question is raised as to the authenticity of the original, or (2) in the circumstances it would be unfair to admit the duplicate in lieu of the original.”

A duplicate is defined in Federal Rule of Evidence 1001(4) as: “a counterpart produced by the same impression as the original... by mechanical or electronic re-recording ... or by other equivalent techniques which accurately reproduces the original.”

Thus, hard drives, diskettes, tapes, memory sticks, and digital data stored in memory in devices such as cell phones, pagers, and cameras, all meet the definition of original evidence, and forensically produced copies meet the definition of duplicate evidence.



## Best Evidence

The second perspective involves the court's acceptance of digital evidence as the "best evidence" (which can be either the original or duplicate data). Federal Rule of Evidence 1001(3) states: "If data are stored in a computer or similar device, any printout or other output readable by sight, shown to reflect the data accurately, is an 'original'."

Examples of digital "best evidence" include individual email messages, Internet chat transcripts, server logs, or personal pictures, sound files, writings (documents), an entire hard drive (consisting of a sector-by-sector copy), a hard drive partition, or a file directory. The best evidence concept is frequently used in investigations involving digital evidence when the original evidence cannot be seized based upon technical limitations or legal restrictions in the search warrant or consent to search. In such instances, an on-site copy is made in a forensically acceptable manner, and processed in the laboratory at some later date. Approximately 30% of all DEA digital evidence is acquired on-site as best evidence. Typically, this type of evidence collection is needed for seizures at commercial businesses, where suspect records are commingled with licit files, or in circumstances where physical removal of the computer (or central server) would cause undue hardship on a business (such as payroll, sales, or intra-office communication), or endanger patients by making their records at a pharmacy or doctor's office unavailable. The growing use of distributed network storage techniques, and ever larger storage capacities on personal computers, will likely result in a continuously increasing need by law enforcement to acquire data on-site, and selectively. A complete copy of an entire hard drive is too time consuming to make in many circumstances, and also would probably exceed the ability of an investigator to review it all in a timely fashion.

## Digital Evidence Authentication

Digital evidence presented as best evidence must also be able to be authenticated. Such authentication can take many forms, but the general Federal Rule of Evidence (Rule 901(b)(4)) interpretation involves the establishment of evidence that is "distinctive" in its "appearance, contents, substance, internal patterns or other distinctive characteristics, taken in conjunction with circumstances." Possible digital evidence authentication methods include date/time stamp file information, software registry information, digital signatures, computer time line analyses, physical computer access, witness first-hand accounts, file access privileges, file password protection, and (most importantly) file content.

Forensically accepted procedures that are grounded in the scientific method promote a conclusion of trustworthiness. Some standard forensic best practices that are used in digital evidence laboratories include: 1) use of validated examination techniques and software; 2) use of positive and negative examination controls; 3) routine checking of examination instrumentation for potential hardware or software problems; 4) conducting quality assurance checks involving peer reviews, technical reviews, and administrative reviews; 5) providing for examiner qualification and regular proficiency testing; and 6) use of binary mathematical techniques (such as the MD-5 or SHA-1 hash algorithms) that support that a copy is the same as its original with a stated measure of uncertainty.

The basis of these techniques is outlined in the 1993 Supreme Court ruling in *Daubert v. Merrell Dow Pharmaceuticals*, in which the criteria required to admit expert scientific testimony in a federal trial was clarified. The Supreme Court ruled that a judge should consider: 1) Whether the theory or technique in question can be (or has been) tested; 2) Whether it has been subjected to peer review and publication; 3) Whether the technique has a potential error rate; 4) Whether there are standards controlling the operation; and 5) Whether there is widespread acceptance of the theory or technique within the relevant scientific community.

Several organizations have already published general best practice guidelines or inspection criteria for Digital Evidence programs, including the Scientific Working Group on Digital Evidence ([swgde.org](http://swgde.org)), the International Association of Computer Investigation Specialists ([iacis.org](http://iacis.org)), and the American Scientific Crime Laboratory Directors Laboratory Accreditation Board ([asclclab.org](http://asclclab.org)). Best practices has also been a continuous theme over the past 68 issues of this Column.

## Chain of Custody

Finally, the collection, handling, and storage of digital evidence, irrespective of whether the evidence consists of business records or best evidence, must have a clear chain of custody. This is especially important in digital evidence forensics because of the fungible (easily changed) nature of the evidence (for example, file date and time stamp information is changed by opening or copying a file, temporary file data may be destroyed by simply rebooting the operating system, and file fragments can be over-written by storing data). Evidence admissibility includes a hand-to-hand chain of accountability, particularly when the evidence is either fungible or non-distinctive (that is, lacking unique identification information). Digital evidence is often nondistinctive. For example, many generic computers do not have serial numbers on their outside cases, and storage media rarely has a unique identification. This lack of unique identifiers can only be compensated for with a continuous chain of custody, good evidence labeling, and secure packaging (i. e., using tamper resistant seals or security tape).

## Conclusion

The introduction of computer evidence in court must meet generally acceptable measures of reliability. Digital evidence forensic examiners must ensure that the evidence can be authenticated, and that there is a clear chain of custody while the evidence is in their custody. Digital Evidence expert witnesses must be able to communicate how the evidence was collected, labeled, handled,

examined, and reported. In the final view, evidence is evidence, and the rules regarding evidence are as applicable to digital objects as they are to other forms of evidence. If there is any unusual aspect to digital evidence, it is the fact that it can be complex to understand (but so is DNA), and that it can be duplicated (but so can latent fingerprint data be copied). Such distinctions are not significant, and basic evidence collection, handling, and examination methods still apply, and should be practiced.

Questions or comments?  
 Email: Michael.J.Phelan -at- usdoj.gov

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